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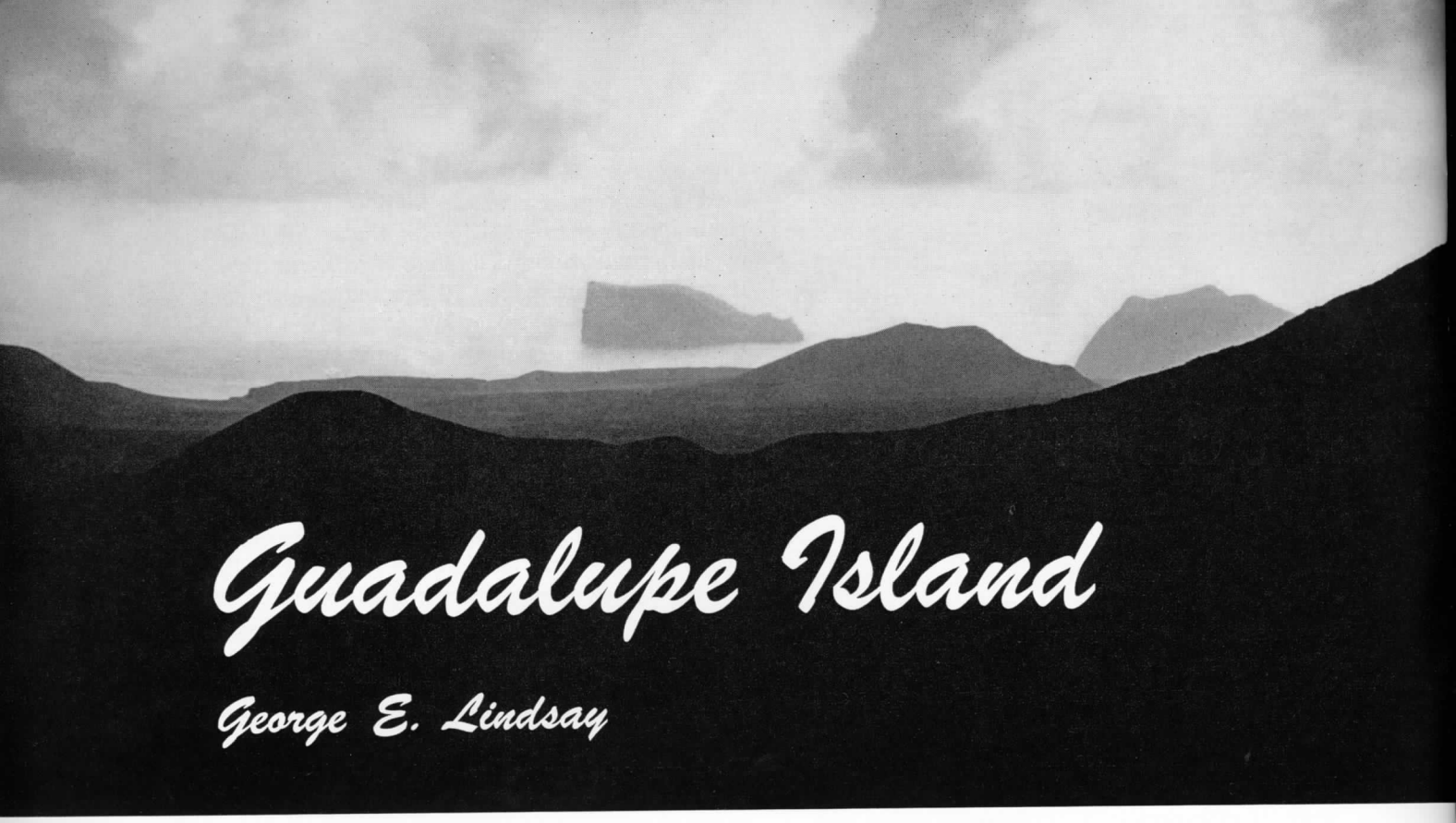


Guadalupe Island

George E. Lindsay

I FIRST saw Guadalupe Island just at dawn one morning many years ago. We had left the Todos Santos Islands, close off Ensenada, twenty-four hours before. All day and all night our squat little ketch, the "Marviento," had slopped along on her southwesterly course, rhythmically yawing as each of an endless succession of following seas overtook her, lifted her stern, then her bow, and ran on ahead as we dropped into the next trough. Some porpoises had joined us for a while, but we were too slow to interest them for long. Two albatrosses stayed with us, flying on ahead and lighting on the water until we caught up, but they, too, finally left us during the night. We had passed through an armada of by-the-wind sailors bobbing along, "men of war," little animal sailboats two or three inches long, light blue with a deep blue border and a colorless sail set at an angle.

Reid Moran, the botanist, and Lewis and Marcho Cavanagh, owners and crew of the "Marviento," were my companions, and we were on a carefree cruise to the islands off the northwest coast of Mexico. Guadalupe was our principal objective, and the most interesting of all. Lying about 250 miles south of San Diego and 150 miles off the peninsula of Baja California, it is the exposed 4000-foot top of a 16,000-foot volcanic peak. Depths of 12,000 feet and more surround it on all sides, and there is no reason to believe that it has ever been connected to other land masses.

There is something special about truly oceanic islands. All of their plants and animals must have reached them through or over the sea. Many have been isolated long enough to allow for the development of new kinds of organisms. Isolation has also served to protect some ancestral forms that have been replaced in other areas. For these reasons the plants and animals we would find on Guadalupe would be of particular interest to us as biologists. We were impatient to get ashore.

Guadalupe Island is about 22 miles long from north to south, and four to six miles wide over most of its length. The highest part is at the north end, where precipitous slopes and magnificent sheer cliffs tower over the sea or narrow beaches of cobbles and sand. The central part is a plateau sloping toward the south end, but the whole island is very rugged. Most of the base rock is red lava, and several of the lesser peaks are cinder cones. Recent research has shown that the oldest lava flows occurred about 7,000,000 years ago.

Two little islands lie off the south end of Guadalupe. Inner Islet (Islote Toro) is a rounded rock 750 feet high, yellowish and capped with black lava. Outer Islet (Islote Zapato) is about two miles offshore. Its western part is a cup-shaped volcanic crater; its southeastern edge is a sheer and even overhanging sea wall 670 feet high. At the

Photographs by George E. Lindsay and Reid Moran

Left, view, from the southern tip of Guadalupe Island, of Outer Islet, known to the Mexicans as Islote Zapato (Shoe Island).

northwest tip of the island the rim of the crater dips to less than 100 feet from the water, and can be reached, waves permitting, by scrambling up the steep slope. This islet was of particular interest to us.

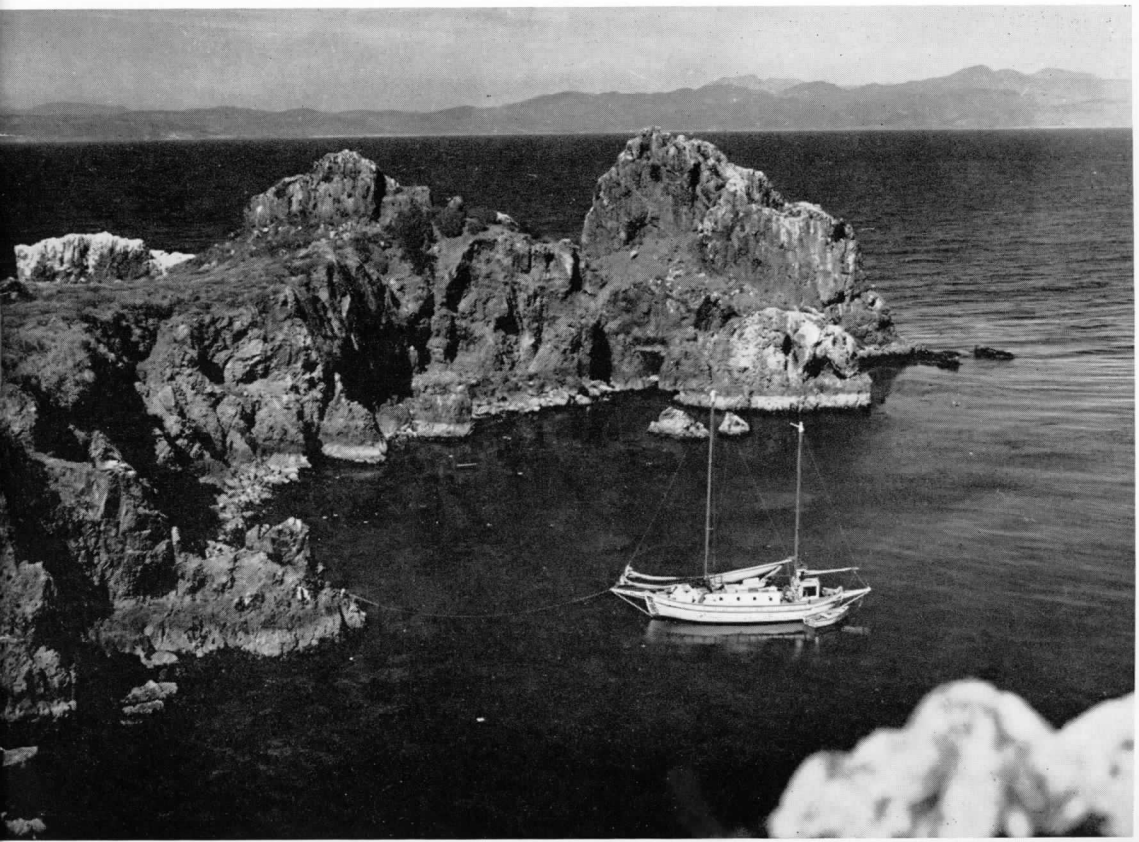
We scanned the towering cliffs of Guadalupe as we approached the north cape. Scattered pine trees lined the ridge. We saw a crowd of huge elephant seals on the black sand beaches of a cove. And as we came closer, we heard their grunts and roars above the sound of the surf. Lewis brought the "Marviento" around and we put the dinghy overboard, and Reid and I rowed toward shore.

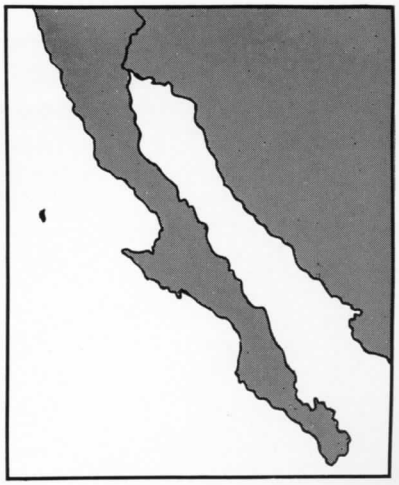
Elephant seals are incredible animals. They are immense. The males may exceed sixteen feet in length and weigh perhaps three tons. We were a little nervous as we approached the beach, wondering what our reception might be, but there was no reason for concern. The one place we thought we could get our little dinghy through the breakers without swamping was just in front of a group of sleeping bulls, and they paid no attention to us when we came ashore.

The large males have a trunk or proboscis about sixteen inches long, which is flexible and pendant when the animal is not excited, and imparts an elephantine appearance. A bull makes a snorting or roaring challenge by throwing his head back, opening his mouth wide, letting the tip of his proboscis fall into it, and exhaling in short blasts. The resulting tone is resonant and sounds far away—it is a challenge between males and is constantly heard during the midwinter breeding season. Surely the world's noisiest sleepers are bull elephant seals. They take very deep breaths, then hold the air sometimes as long as seven minutes, no doubt an adaptation to their deep diving habits. They then exhale a blast which, released through sixteen inches of flaccid proboscis, produces a really awe-inspiring snore.

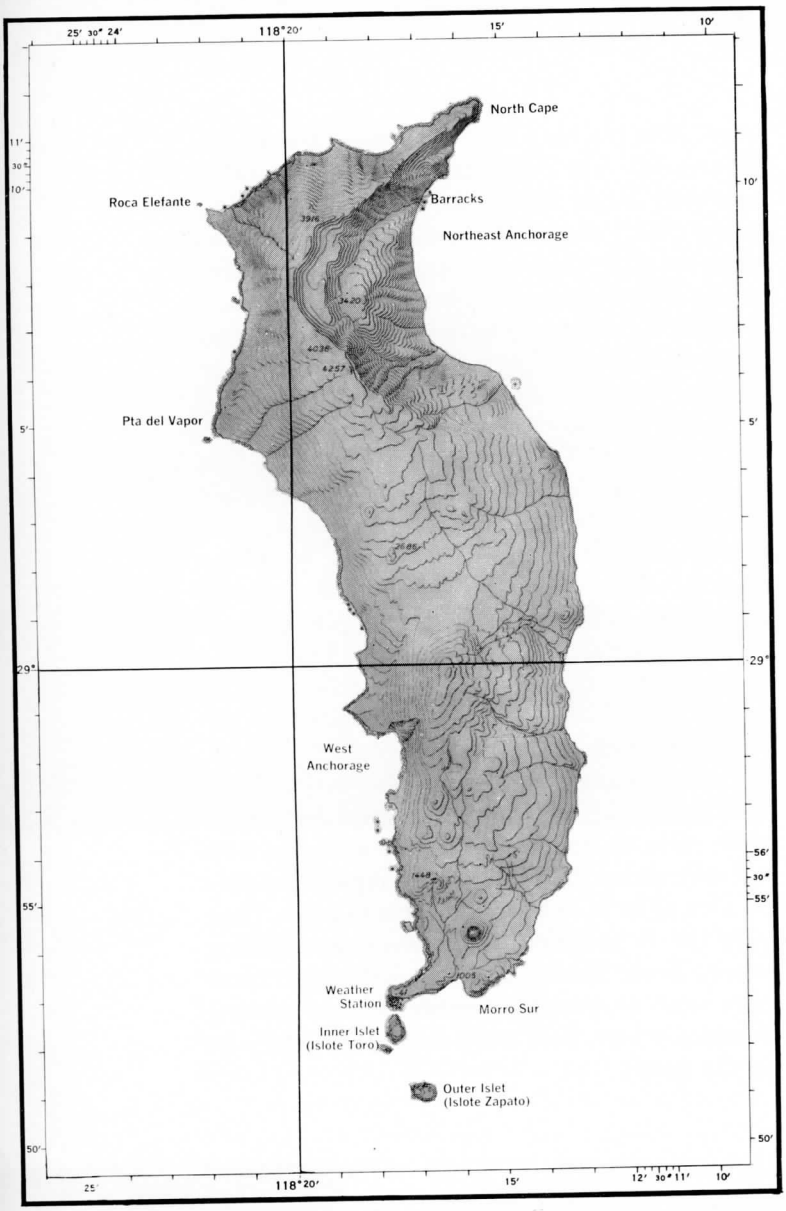
Females are less than one fourth as heavy as the males and lack the overdeveloped "trunk." They have large, beautiful eyes. While they do not snort or trumpet, they do have a vocabulary. As we approached them they often opened their mouths very wide and made rasping, hissing noises, which sometimes sounded like a prolonged belch. They make other sounds for which there is no polite name. The young pups yelped, squealed, and barked like baby foxes.

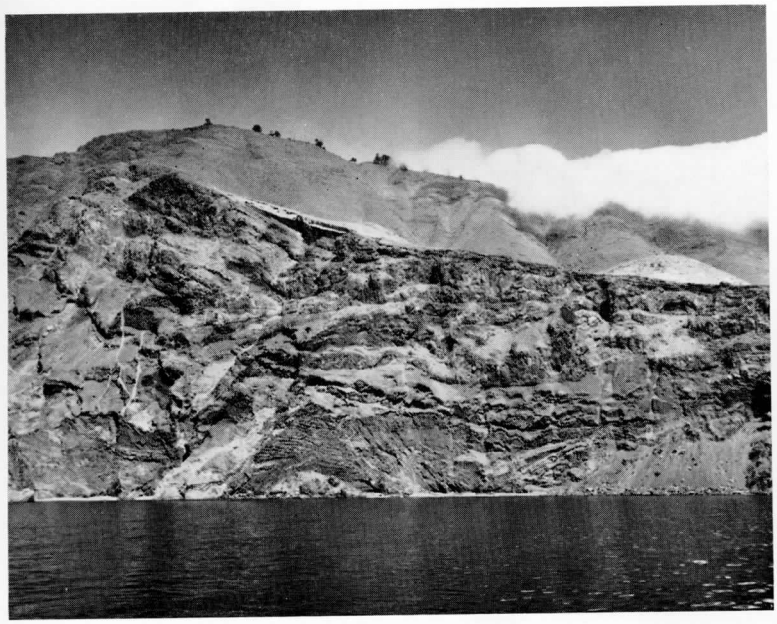
The pups are about forty inches long at birth, black and thin. They often nuzzle the nearest adult, male or female, looking for a nipple. Rich seal milk makes them gain weight rapidly and they are soon so fat as to be scarcely able to move. Their early life is precarious, because of the breeding activity in the harem. The huge bulls often crush them when challenging another male, or moving to engage a cow. Reid and I noticed six dead pups on the beach.





Left, the squat little ketch "Marviento" carried the author on his first visit to Guadalupe Island. Here she is anchored at Todos Santos Island, near Ensenada, early in the voyage. *Above,* map showing location of Guadalupe Island, about 150 miles off the coast of Baja California and 250 miles south of San Diego, near the left edge of the map.





Top, detail map of Guadalupe Island, with contour lines and locations of several places mentioned in the text. *Above,* Guadalupe Island pines *(Pinus radiata* var. *binata)* grow on the north ridge, where fog which condenses on their needles drips to the ground, irrigating the area under each tree.

Elephant seals once inhabited insular and coastal beaches from Point Reyes, north of San Francisco, to Cape San Lazaro, just north of Magdalena Bay. The docile and phlegmatic nature of the beasts, coupled with absolute lack of timidity toward man, made them an easy prey for the whalers of the early 1800s. Seal oil was valuable, and the herds of giants were massacred wherever they were found. Whole rookeries were exterminated for the trypots. By 1869 it was reported that they were "nearly if not quite extinct." In 1884 a few more survivors were found and killed. Then in 1892 Charles T. Townsend discovered nine animals on Guadalupe Island, seven of which were taken for museum specimens. Since the Baja California coast and islands were then periodically visited by parties hunting sea lions for hides and oil, it seemed improbable that any elephant seal could survive. A few fortunately did escape and for some years were forgotten and allowed to increase in their redoubt area on Guadalupe. In 1907 Charles Harris, collecting for the Rothschild Museum, found a small herd and reported that there were "a few left he did not shoot." In 1911 Townsend returned on the "Albatross" to find about 125 animals at Elephant Beach, on the northwest side of the island. This marked the first increase in numbers since the slaughter had begun, and the increase has continued steadily until today.

In 1922 the California Academy of Sciences, the San Diego Society of Natural History, and the National Geographic Society, in cooperation with the Mexican government, sent an expedition to Guadalupe Island on the Mexican patrol boat "Tecate." Dr. G Dallas Hanna, who is still an Academy curator, found 264 adult male elephant seals. As a result of this expedition, President Obregon declared Guadalupe Island a government reservation, prohibited unauthorized landing or killing or molesting of the seals, and established a garrison of soldiers to guard against poachers.

The ever-growing herds reoccupied all suitable beaches on Guadalupe, and then expanded to the San Benito Islands, 100 miles to the east. Finally they reappeared on the California Channel Islands and recently have established a breeding colony on Año Nuevo Island a few miles south of San Francisco. Theirs has indeed been a remarkable recovery. The present population exceeds 10,000.

We spent the afternoon with the elephant seals and were wholly fascinated by these wild animals that have no fear of man. Mothers with pups would assume a defensive position if we approached closer than an arm's length, but a sleep-

ing bull only opened one eye for a moment when we patted his back.

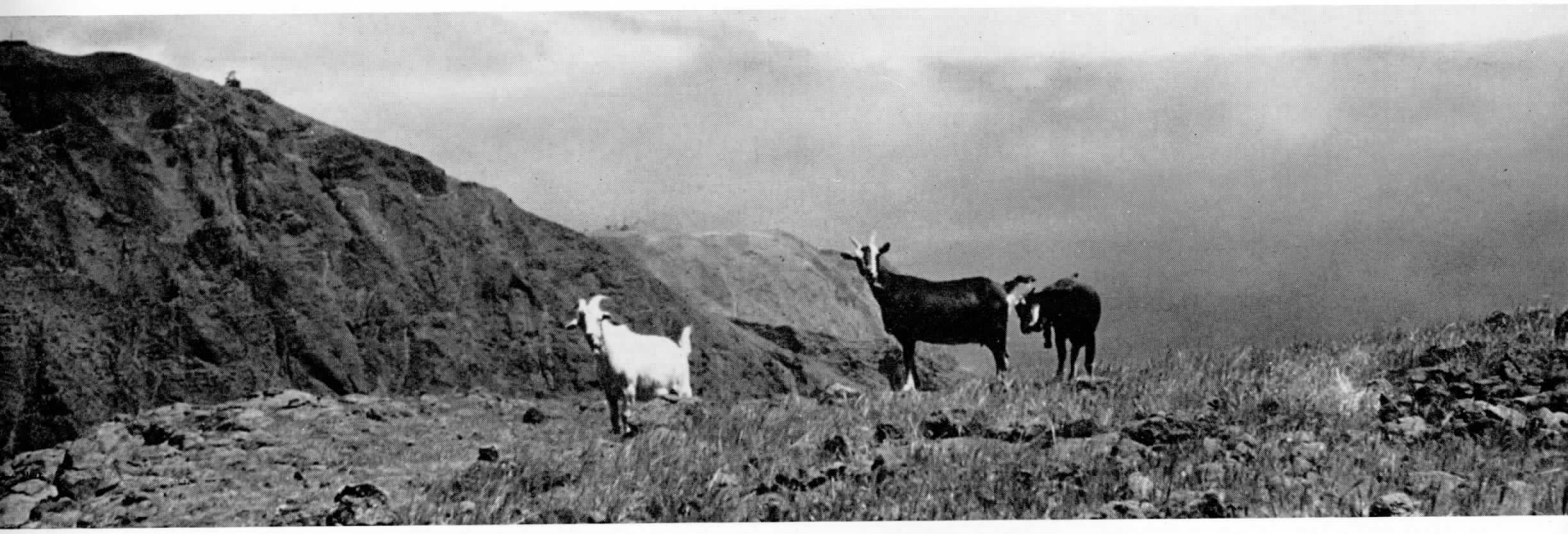
We anchored for the night at the mouth of a canyon which held deserted adobe garrison buildings. There was some ground swell, and Lewis put out a stern anchor and secured a bow line to a boulder on shore, to make us more comfortable. With each surge the bow line would pull out of the water. A half grown elephant seal adopted this as a plaything, swimming over and under it in an aquatic version of skipping rope, then finally, grasping it in his mouth, allowed himself to be pulled halfway out of the water with each swell.

The next morning we sailed around the north end of the island. Cliffs 2000 feet high rose from the beach, and above these were steep slopes covered with fan palms, a beautiful endemic species, *Erythea edulis*. Even higher were scattered Guadalupe Island pine trees, *Pinus radiata* var. *binata,* an insular form of the Monterey pine which is native no farther south than San Luis Obispo County, California. Coasting down the west side of Guadalupe we saw high on the island the remaining grove of the endemic cypress, *Cupressus guadalupensis*. This, too, is a beautiful tree, which, like the rest of the native plants, seems doomed to extinction on the island. The reason is goats. Innocent goats are the villains of Guadalupe.

Even from the boat we could see hundreds of goats in long files on trails near the top of the island. Goats were probably first introduced by whalers or sealers in the early 1800's. In the absence of predators, and with abundant food, they increased phenomenally. Finally, about 1860, a party from Baja California attempted to exploit the animals, and soon afterward the island was purchased by a California company which introduced white angora goats with the intention of harvesting wool. The first naturalist to visit the island, Dr. Edward Palmer, came in 1875 to collect plants and animals. He wrote that Guadalupe was a paradise, but it was already overrun with angora goats, and some of the 119 species of plants which he found persisted only on cliffs inaccessible to them. A Santa Barbara plantsman, Dr. Francescho Franceschi, found the destruction of the native vegetation far progressed in 1893 and noted that shrubs were most vulnerable, being completely chewed down during dry seasons when annuals were in the form of seeds.

Left above, Elephant seal pups are sometimes crushed by the huge males as they move through their harems. *Left,* Elephant seals cover all of the suitable beaches on Guadalupe Island. *Above,* Dr. Carl L. Hubbs, the famous biologist, greeting a male Elephant seal. Dr. Hubbs has continued his studies of the marine mammals of Guadalupe Island for many years.

Goats, which were probably introduced by whalers and sealers in the early 1800's, have destroyed most of the vegetation of Guadalupe Island. Some of the endemic plants are probably extinct, while others persist only on cliffs inaccessible to goats.



Several further attempts were made to harvest Guadalupe's unnatural resource. Corrals were built around the major springs in about 1900, and great numbers of the goats were caught and butchered for their hides and tallow. They were harvested again during the first World War, and in 1930 a small cannery for goat meat was established at the place of our first anchorage. None of the projects was successful, and during the last thirty years the goat population has been intermittently at its very maximum limit. Thousands starve during dry years. Some are reported to drink sea water and many eat kelp on the beach. The hungry animals strip even the dried leaves from the palm trees, which normally carry a heavy shag, and gnaw the bark of the large cypress trees. A once-great stand of California junipers which extended over miles of the island is gone. There is almost no replacement of seedlings of pines or cypresses or palms. The mature trees are too large to be damaged by goats. When these die there will be no more. Many of the endemic plants are now extinct, and others exist only on vertical cliffs.

We sailed on to Melpomene Cove at the south end of the island and visited the only settlement—a small weather station maintained by the Mexican government. We met the staff, two young meteorologists, one of whom had his pretty wife with him. Their monthly supply vessel was overdue, and we gave them gasoline for their generator so that they could contact the mainland by radio. They were very friendly, but we wondered about their isolated existence. Some months after we left, tragedy struck. The husband was murdered, and the next supply vessel returned the corpse, the widow, and the murderer to Ensenada. A detachment of Mexican marines, each man accompanied by his wife, was sent to maintain the station.

The two offshore islets intrigued us, because we could see vegetation. There had never been goats on them. Inner Islet was too precipitous to climb, so Reid and I attempted to shoot plants from the cliffs with a rifle. We found this difficult to do from a bobbing dinghy, and were only moderately successful. We did drop specimens of the giant sea dahlia, *Coreopsis gigantea,* which may be the only plants ever collected from the huge rock. This has not been found on the main island since 1875, doubtless a victim there of the goats.

The next day we attempted to get ashore on Outer Islet. We cruised around it but the Pacific swells were running high. A small colony of California sea lions, two or three of which appeared to be remarkably light in color, occupied the base of the cliff. At only one place was there any chance of our landing, but it was exposed to the surging swells. Lewis and Reid tried to make it in the dinghy, but crashing waves made them turn back. They boarded the "Marviento," and we powered up the east side to the northwest anchorage.

Unknown to us, and concealed in black lava recesses, we passed a colony of the rarest of sea mammals, Guadalupe fur seals! We were looking for them because a fisherman named W. O. Clover had brought two young ones to the San Diego Zoo in 1928, reporting that he had captured them with nets in the sea caves and that he had seen about sixty animals on that coast we were passing. We failed to see any, as had several other parties which had previously searched, and assumed that they were extinct. Fortunately, we were wrong! In November 1954 Dr. Carl L. Hubbs and his boatman,

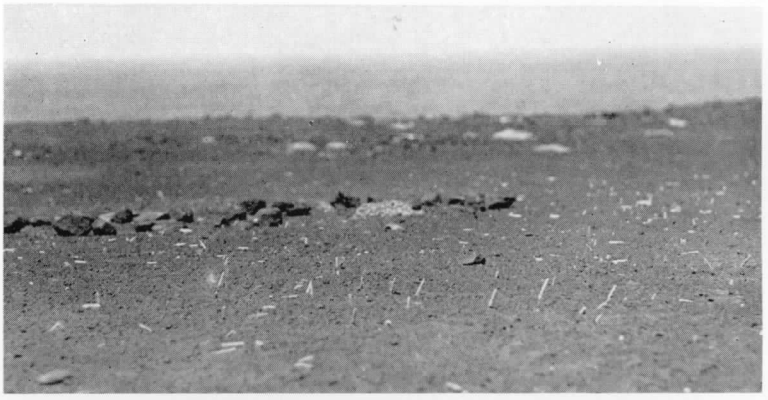
Eddie Arebalo, discovered the colony and counted fourteen. When I visited it with Dr. Hubbs in 1955, I realized why we had missed them before. They inhabit a very rough section of coastline, and their color is a perfect match to that of the black lava. (See Hubbs, Carl L. "Back from Oblivion," *Pacific Discovery,* Vol. 9, No. 6, pp. 14-21. Nov.-Dec. 1956.)

Guadalupe fur seals were formerly resident of the coastal waters of California and Baja California, from the Farallones south. They were heavily hunted for their very valuable fur from about 1800 on. At one time there may have been a hundred thousand animals on Guadalupe. Russian sealers, who were taking them on the Farallones, are thought to have brought Aleut Indians from Alaska to slaughter the seals on Guadalupe and dry their skins. Stone houses, the remains of which we saw, were built. Drying yards were cleared, and in 1922 Dr. Hanna found thousands of cypress pegs, used to stretch the skins, still in place.

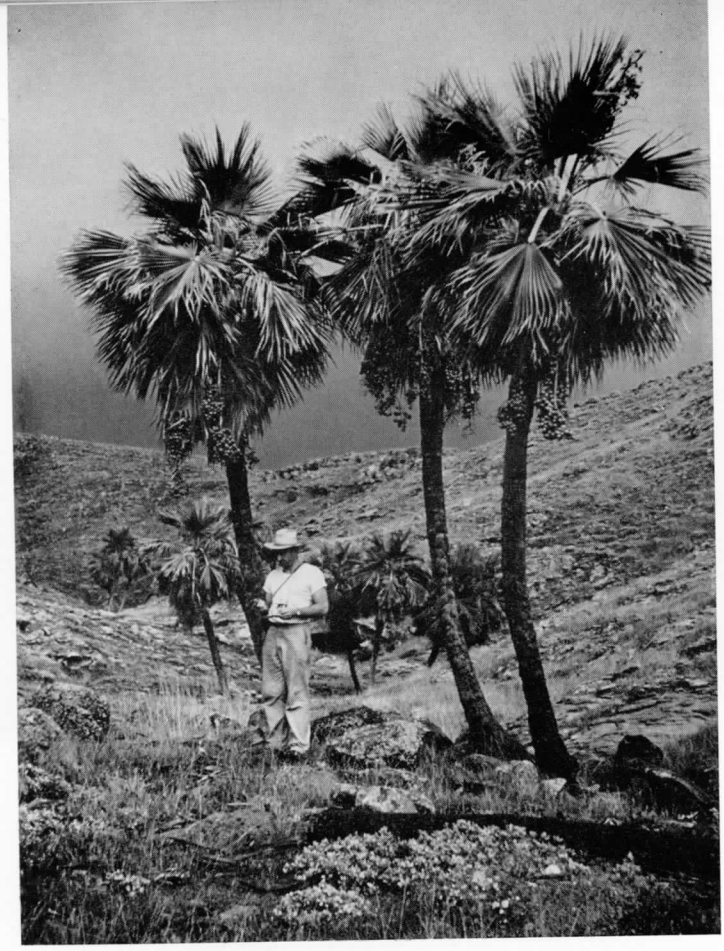
We were depressed by the thought that this beautiful animal was extinct, so it is a special pleasure to report that the herd is increasing, under the watchful eyes of Dr. Hubbs and other biologists. The last four counts, over the past two years, all exceeded 200. If they can increase as did the nucleus herd of elephant seals, which also survived because of the isolation of Guadalupe, they, too, may one day recolonize the islands of their former range.

Thus far we had been working around the margin of Guadalupe Island—now we planned an assault on the highlands. Trails led upward from the abandoned garrison buildings. Reid started to the north ridge, carrying a plant press and little else. He found that night very cold on the ridge. The following day Lewis and I climbed to the cypress grove in the north central part of the island. The deceptively easy trail soon ended. We continued up the steep slopes, which were covered with loose chunks of lava. Four hours later we came to a large spring, with the ruins of an adobe building nearby. Our canteens had long been dry. We removed a goat's carcass from the spring and waited for the water to clear before we drank. Another hour and we were in the cypress grove.

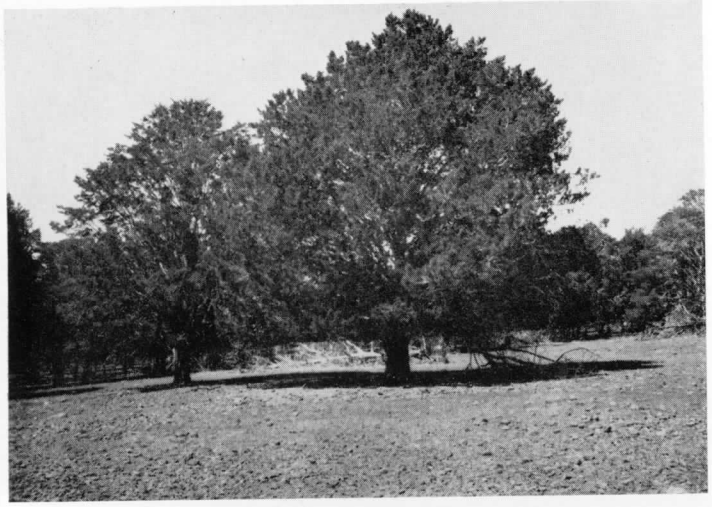
When Palmer camped there, the branches of the trees swept to the ground and gave him an almost windproof place to stay. Now the noble trees looked like a planted orchard. All of the branches were cropped off just as high as a goat could reach. There were no small trees. Goats climbed any large tree which was scalable. The



Above, deserted garrison buildings near Northeast Anchorage. *Center,* in 1922 G Dallas Hanna found cleared areas for drying skins of Guadalupe fur seals, with cypress pegs, used to stretch the hides, still in place. (Photo by G Dallas Hanna, July 17, 1922.) *Below,* a male Guadalupe fur seal, a rare animal once thought to be extinct, sunning himself on a rock.



Above, botanist Reid Moran and the fan palm, *Erythea edulis,* native only on Guadalupe Island. *Center,* an endemic cypress, *Cupressus guadalupensis,* is cropped off as high as a goat can reach. Seedlings are eaten as soon as they appear. When the present trees have reached their life span they will become extinct on Guadalupe Island. *Below,* the single remaining cypress grove, a remnant of the former forest.



grove was at least a mile and one-half long and a half a mile wide. Someday, when the present trees have reached their life span, they will become extinct on Guadalupe Island. Seeds have been brought to California and fine specimens grow in many parks, but apparently they don't produce seeds in cultivation.

At present there is a single cypress grove. Palms are especially abundant on the north slope of the island and also occur in canyons nearly to the south end. Guadalupe Island pines and Island Oaks, *Quercus tomentella,* grow on the west slope of the ridge at the north end. There fog condenses on the trees and drips to the ground, making moist areas. As the forest has disappeared the moisture has also, so that former springs are now dry. Guadalupe is increasingly a desert.

We rested under the cypress trees. A rustling in the litter attracted our interest, and after a short chase we captured a house mouse! There were no indigenous land mammals or reptiles on Guadalupe, but whalers or early goat tenders introduced domestic cats and house mice—the last probably unintentionally. Like the goats, these animals increased rapidly, became feral, and spread over the land—again with disastrous results. When Palmer camped in the cypress grove, the bird population included 42 species and subspecies, nine of which were endemic. These were mostly Californian in relationship, though one, the Guadalupe caracara, a beautiful hawk-like bird, was probably of Mexican derivation. The other endemics were the Guadalupe wren, Guadalupe towhee, Guadalupe flicker, Guadalupe petrel, Guadalupe rock wren, Guadalupe house finch, Guadalupe junco, and dusky kinglet. The native birds with no instinctive fear of predatory animals were an easy prey to cats. The Guadalupe wren, towhee, flicker, petrel, and caracara soon became extinct. Both cats and goats are responsible for the destruction, the goat by completely destroying the habitat of the towhee and wren. The caracaras, which were thought to prey upon the kids, were poisoned by the goat keepers. The flicker was brought to its doom by the cats, as was the petrel, which nested among the cypress trees in a most unpetrel-like manner. The San Diego Natural History Museum has three study skins of the Guadalupe caracara, taken by Palmer in 1875. The Academy collection contains two study skins of the Guadalupe petrel, including the type specimen. These were the only bird skins saved at the time of the fire in 1906 and are numbers 1 and 2 of our 90,000 birds.

While feral cats and mice are very common

all over the island, as shown by many skulls and an occasional living animal, some of the birds are still abundant and have not yet lost their fearlessness. As we rested, rock wrens and house finches hopped about us and even lighted on our outstretched arms.

Lewis and I made our slow and painful way down the mountain. Bands of goats, of all colors, often ran in front of us. We hated them for what they had done to Guadalupe. Still, when we came upon an emaciated old billy goat with his curling horns tangled in a fence, we freed him. It is the fault of people, and not really that of the goats, that Guadalupe has been devastated.

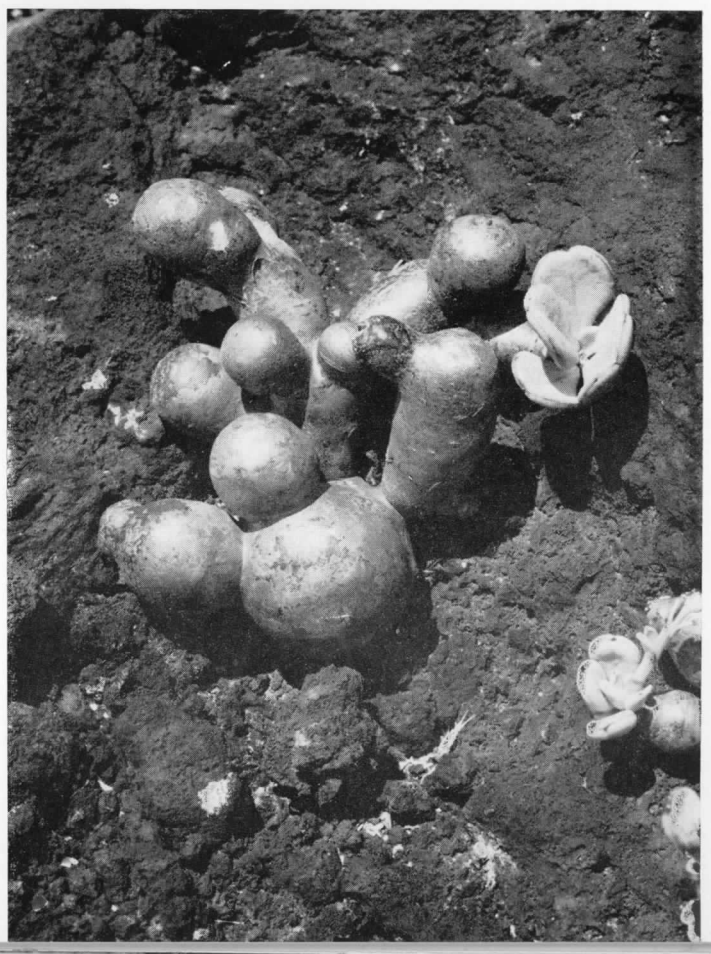
Lewis and I were on the beach at dark, and boarded the "Marviento." Reid, who had been gone two days, was not yet there. Now knowing how rough and dangerous the north cliffs were, we became apprehensive and sat on deck scanning the dark heights above us. Finally a shout from shore—he was back and safe.

In spite of our fatigue, the night was not restful. Violent gusts of wind, williwaws, rushed downward and whirled in every direction. I took the anchor watch from midnight until four, and the wind and sea were both toward shore much of the time. When Lewis relieved me, we found the skiff had fouled the bow line and was overturned, but we righted her and everything was intact, including the oars and locks. It was rough in the morning when Reid and I went ashore for the cameras, plant presses, and equipment that we had cached in a hut. The surf was high and Reid was up to his neck, putting the cargo into the skiff while I kept it headed into the breakers. We finally, after three trips, had everything aboard, and dry.

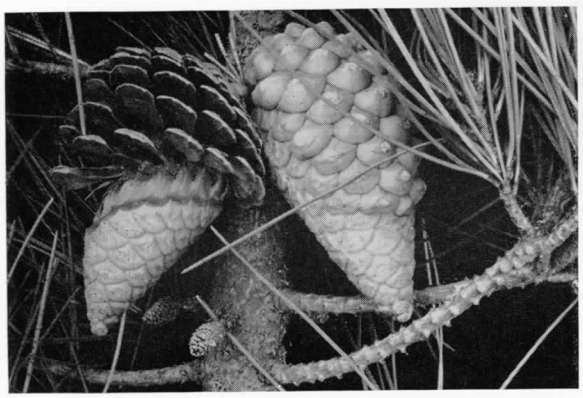
Our time for Guadalupe was running out. We sailed back to Melpomene Cove and anchored. Rowing ashore, we noticed some strange looking plants on some offshore rocks. We landed and Reid looked at them, muttering "weird, weird." They were gray, thick-stemmed, contorted succulent shrubs, with rosettes of fat bluish-green leaves with bright purple margins. Some bore terminal floral stems with panicles of beautiful rose-colored flowers. This was the rare *Talinum guadalupense,* which had been collected only once, in 1897. It belongs to the portulaca family. The find made us more determined to land on Outer Islet.

The next morning we decided to make the attempt—it was our last chance. The rushing swells which sloshed up on the only ledge on which we could land were too rough for the dinghy. We stood off, undecided what to do, when someone

Top, Perityle incana is an endemic that thrives on cliffs and is thus in no danger of extinction. *Center, Baeriopsis guadalupensis* is an attractive succulent composite which was named by John Thomas Howell. It grows only on Guadalupe Island. *Below, Talinum guadalupensis* is a strange succulent. Its thick gray stems bear rosettes of fat bluish-green leaves with purple margins.



Pinus radiata, var. *binata,* like the palms and cypresses, persists only as mature specimens. About 400 Guadalupe pine trees still survive, *right.* However, seeds have been collected from the cones, *below,* and are being grown in forestry nurseries in New Zealand and in Mexico. Like the junipers, cypresses, and oaks, the pines once covered much larger areas, and the fog-drip from all these trees provided water not only for the trees but other island plants, and for the springs, which are mostly dry now that the trees are nearly gone. Without this moisture Guadalupe is becoming desertlike.



suggested using a rubber life raft. On impulse we pulled the cord which inflated it from carbon dioxide bottles, and it filled out, expanding so there was no room for it aboard, and was pushed over the side. Reid and I jumped in and with paddles guided it toward the rock ledge. A surge lifted us high, and we jumped ashore with no difficulty, pulling the rubber boat after us.

At last, we were where goats had never been. We scaled the outer lip of the crater, marveling at the plants we were finding. Several were new records for Guadalupe Island; some were endemics now extinct on the main island. Reid found a curious new species of *Dudleya* with contorted floral stems. There were two species of island mallow, one undescribed. There were little pincushion cacti, and the floor of the crater was covered with the strange *Talinum* and with sea dahlias.

About 164 kinds of plants were native to Guadalupe Island, and about 32 of these were endemic, occurring nowhere else. Many of them are probably now extinct. The other 132 are of wider distribution, mostly in California and the Channel Islands. Another forty or more species are introduced weeds, principally from Europe and now widespread in America and the rest of the world. Over much of the island they have replaced the original vegetational cover, just as they have in the overgrazed sections of California. These probably came with the goats. A typical example of such invasion is the wild barley, a European grass. In 1885 E. L. Greene found "only a few tufts near the cabins on the plateau," in 1925 Herbert L. Mason reported it as "very common," and in 1932 John Thomas Howell noted it as "the most common plant on the island." These weeds survive because they are in the seed stage when it is dry and goat forage is scarce. After rains they grow rapidly and complete their life cycle to the seed stage again, while there is ample pasturage for the goats. The native shrubs and trees do not have this protection and are gnawed away when there is no other food.

Two little islets lie off the south end of Guadalupe. At the left is Outer Islet, also called Islote Zapato, a cup-shaped volcanic crater. There the author and his companions found new species of plants, as well as others which are probably now extinct on the main island. At the right is Inner Islet, which the Mexicans call Islote Toro. It too has undisturbed vegetation on its top, but it has not yet been scaled.

About 25 of the native plants have not been seen since the turn of the century; many of them probably are extinct on the island, some are still turning up.

We had only an hour and a half on Outer Islet that first visit. Lewis was concerned because the seas were rising, so shot the rifle to signal for us to return to the "Marviento." We boarded without mishap and set our course for the San Benito Islands, 100 miles to the east.

That was our first visit to Guadalupe. I have returned several times, and Reid, many more. He has scaled the cliffs and searched the canyons, carrying a 24-foot tree trimmer to collect plants where no goat could reach. He is preparing a flora of Guadalupe Island.

Conservationists who are familiar with the story of Guadalupe Island are disheartened by what has happened there and are frustrated because there is no way that a spoiled island can be restored or that an extinct species can be made to live again. The damage which resulted from man's tampering with that island's delicate biological balance is irrevocable. Less than two centuries have seen the devastation of a "natural paradise" which had resulted from millions of years of evolutionary development. The desolate island's best use may be an example to man—but man has had so many similar examples, and has given them so little heed.

The Guadalupe picture is not all gloomy, however. The elephant seals made a remarkable recovery with a minimum of protection. The Guadalupe fur seals still survive and rigid legislation and enforcement might well make possible a dramatic increase in their population. This matter is the subject of international concern and is the responsibility of the Mexican *Direccion General de Pesca e Industrias Conexas.*

On the other hand, the future of Guadalupe Island's remarkable native plants is anything but bright. Control of the goats is essential if anything more than a flora of introduced weeds is to survive. Many possible methods of eliminating the goats have been suggested. Releasing predators, such as pumas or coyotes, is one. But would predators endanger the helpless newborn fur seal pups which are, for a period, confined to land? Could predators be introduced in sufficient numbers to have any effect on the rapidly-reproducing goats? Another suggestion is the harvesting of the goats by hunters and their utilization for food, but the rugged terrain of the island precludes this as an economically feasible project. The wholesale use of poison, or poisoning or fencing off the few springs, is distasteful and probably impractical.

One suggestion has promise. That is for the construction of exclosures which would keep the goats out of selected areas, such as the cypress forest or the ridge on which the pines grow. Goat-proof fences would be difficult to construct but would be possible. And protected areas would allow seedlings of trees and other plants to grow. It would be a costly project and would require maintenance. I like to think that it will be done.